

A Proposal for Measuring and Implementing Group's Affective Relevance in Collaborative Information Seeking

Roberto González-Ibáñez and Chirag Shah

School of Communication & Information (SC&I)

Rutgers, The State University of New Jersey

4 Huntington St, New Brunswick, NJ 08901

rgonzal@eden.rutgers.edu, chirags@rutgers.edu

ABSTRACT

In an interactive information-seeking environment, it is important to consider more user-centric notion of relevance, which includes motivational and affective relevance. In this article we introduce the notion of group's affective relevance for collaborative information seeking. We explore different ways of measuring it and examine how these measures are related to the performance of teams. In addition, we propose a new model for implementing group's affective relevance in information systems that provide support for collaborative information seeking.

Categories and Subject Descriptors

H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces—*Collaborative computing, Computer-supported cooperative work*

General Terms

Design, Experimentation, Human Factors.

Keywords

Group's affective relevance, Collaborative information seeking.

1. INTRODUCTION

It is generally accepted that relevance means pertinence, indicating usefulness of the object in question in a particular context. In fact, if we look for definitions in common dictionaries we will find explanations like, "Relation to the matter at hand", "Practical and especially social applicability", "pertinence", "the ability (as of an information retrieval system) to retrieve material that satisfies the needs of user" [10]. Although these definitions are just examples, it is very likely that they represent the general meaning that lay people normally ascribe to this concept.

On the other hand, for several years the field of information science has debated about the concept of relevance. To this end, different authors have done extensive reviews of the concept showing its complexity [1]. Indeed, as described by both Saracevic [12] and Mizarro [11], today we do not talk about "relevance"; instead we refer to it as "relevances", reflecting the multidimensionality of the concept.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

HCIR 2010, August 22, 2010, New Brunswick, NJ, USA.

Copyright 2010 ACM x-xxxxx-xxx-x/xx/xxxx...\$5.00.

In this manner, information scientists today, are able to talk from algorithmic relevance, which is linked to information retrieval systems, to more human versions of the concept, such as motivational and affective relevance. Beyond the various kinds of relevance, none of them consider the dynamic evaluation of information in group contexts, which is the case of collaborative information seeking (CIS) and where the notion of relevance adopts a social dimension. Our interest in this article is to propose and measure a new kind of relevance, namely group's affective relevance (GAR), and also a model for supporting it in CIS environments.

In the following sections we present a brief review of related work, the definition and purpose of groups' affective relevance, the preliminary method we used to evaluate it based on the information collected in previous studies, our observations and corresponding analyses, the model for supporting this kind of relevance in information systems, and finally a general discussion of the results of this work.

2. BACKGROUND

Among the variety of problems and situations studied in the field of information science, relevance is central and probably one of the most important elements. As pointed out above, several authors have studied this concept from different perspective. An important conclusion in this regard is that relevance is more than just a concept with a unique definition; instead, relevance is a multidimensional notion that must be studied carefully based on application domain, goals of an information seeking situation, and related contextual information. For several years the predominant system paradigm established relevance as a central and technical component; however, works such as [4], proposed to shift the focus on the users' perspective, expanding the idea of relevance to new levels. Similarly, Saracevic described a set of relevances that includes system or algorithmic relevance, topical or subject relevance, cognitive relevance or pertinence, situational relevance or utility, and affective relevance [12]. Particularly the latter is considered by different authors as transversal to the other subjective kinds of relevance [1], [3].

It has been assumed in some way that these relevances originally defined for individual information seeking are also applied to more social scenarios, like CIS; nevertheless, few studies have been done for evaluating relevance in this kind of contexts. Zhang for example, proposed the idea of collaborative relevance judgment as a measure of user's search performance [16]. The general idea behind this approach is that certain information is considered more relevant as more users collect it. In the same way and with the aim of exploring relevance and the affective dimension in collaborative settings, we propose group's affective relevance (GAR).

3. GROUP'S AFFECTIVE RELEVANCE

Human beings are able to feel, express, and recognize emotions in their daily lives; particularly when people work together, they share thoughts and opinions in a rational way, but also they are accompanied by emotions. This can be noticed through facial expressions, voice intonation, physiological responses, words, and so on. As reported in [5] and [9], affects may impact either positively or negatively the performance of teams. If these people or groups are working in an information seeking situation, affective dimension may be critical to their collaborative task. Our goal is to understand and evaluate affective relevance for a group in a CIS environment.

Saracevic defined affective relevance as the “*relation between the intents, goals, emotions, and motivations of a user, and information (retrieved or in the systems file, or even in existence)*” [12]. Taking this idea to CIS, we could evaluate the performance of teams in terms of the emotional experiences of their members; but also we could explore how feelings expressed through information judgments, impact the quality and relevance of the information that users gather during the information seeking process (ISP). In addition we could study how users are affected by the judgments of their peers regarding the information they share and how this finally affect to the team as a social system. It is in this sense that we propose group's affective relevance, which we define as the overall emotional experience of each group's member with regard to a specific information object that certain user share with the group. In this sense, group's affective relevance involves a measure and also a model of relevance, whose main idea is that the diversity of both affective-subjective and objective information judgments among collaborators, make possible a better evaluation of the information objects that users collect when they seek information.

In the sections below we present an initial application of the notion of group's affective relevance to a previous study in the context of CIS.

4. METHOD

To commence our investigation on GAR for CIS, we used data previously collected in an experiment of collaborative information seeking [14]. This study involved 42 pairs of remotely located users using a CIS system, called Coagmento [15], in two interactive sessions seeking information on two different exploratory search topics. The participants collected snippets of text from the Web relevant to their tasks. Since the experiment was not originally designed to explore group's affective relevance; we were limited in terms of the data we had to evaluate this idea. As a summary, we had access to chat logs and also to precision (ratio between relevant information and the total amount of information collected. In this formulation, relevant information corresponds to the number of snippets collected by at least two users). With this data, we used the chat logs as a main source to identify affective judgments of information. For this, we coded more than 6000 messages, using two different systems of codes:

1. *Positive, negative, or neutral feeling expressed.*

Such classification is an adaptation of the affective dimension of speech acts described in [9]. In this sense, messages were classified as positive if they involve pleasant feelings, encouragement, positive judgments, satisfaction, and support, among others; on the other hand, negative

messages included opposition, sarcasm, dissatisfaction, and so on. Since the dichotomy positive-negative may not apply to certain messages, especially objective ones (e.g., “Do we have anything showing when social networking started?”), the neutral category was incorporated into the coding system.

2. *Perceived relevance expressed.*

An interesting aspect of the communication in CIS is that users sometimes report to their peers if they find relevant information according to their own criteria. In this manner, in addition to the categories above, expressions such as: “Hey! Check this article, it is awesome” (*positive*) and “mmm, I don't like the way is written and I don't think it help us to complete our task” (*negative*) in a dialog between users were also coded as reflecting affective relevance.

The coding process was done by two independent coders (the authors) and an inter-rater reliability analysis was performed in order to evaluate the agreement between the judges of the messages. As a result, we found high level of inter-coder reliability with Cohen's kappa = 0.773.

It is worth mentioning that due to the characteristic of the data we had, we studied the overall group's affective relevance of each team without taking in consideration the particular information objects that were collected. The main reason of this is because we did not have access to judgments of each information object that was collected, since participants were not asked to rate such information during the ISP and decide based on the group's evaluation whether or not the information should be collected.

5. OBSERVATIONS AND ANALYSES

One of the main challenges of studying group's affective relevance is the operationalization of the concept. As mentioned above, our affective coding system was inspired in [9]. Hence, chat messages were classified under a dimensional approach of emotions considering positive and negative emotions, but in addition we added neutrality as a way to differentiate objective and subjective messages. In their study, Losada and Heaphy analyzed the dynamics of teams through the ratio between positivity and negativity [9]. In a similar way, we analyzed groups' affective relevance and their performance using this ratio and also a modification of it that incorporates neutrality. Below the two equations we used to compute group's affective relevance:

$$GAR_1(pos, neg) = \frac{\sum pos}{\sum neg}$$

$$GAR_2(pos, neg, neu) = \frac{\sum neu}{\sum pos} + \frac{\sum neu}{\sum neg} + \frac{\sum pos}{\sum neg}$$

Because of our interest is on the performance of teams in terms of the way in which they decide whether certain information is relevant or not, we considered in our analyses only those messages that where coded as affective relevance, which corresponds to 8% of the messages.

Using both ways of measuring group's affective relevance, we studied the correlation with our performance measure (precision). The corresponding dispersion graphs are presented in Figure 1 and Figure 2. We found significant negative correlation between GAR_1 and precision ($r=-0.342$, $p=0.027$) and also between GAR_2 and precision ($r=-0.289$, $p=0.063$); however, the latter was not found to be statistically significant.

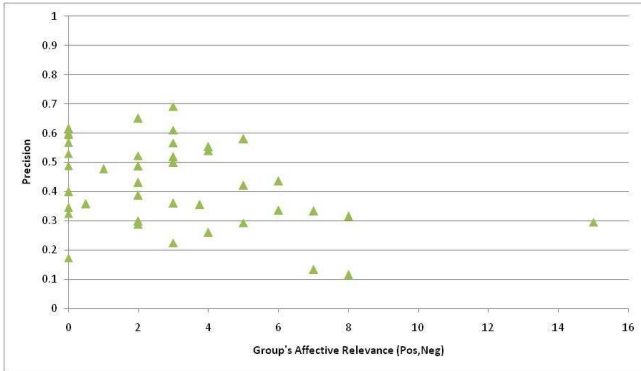


Figure 1: Dispersion Analysis of Precision in terms of GAR using positive and negative information judgments.

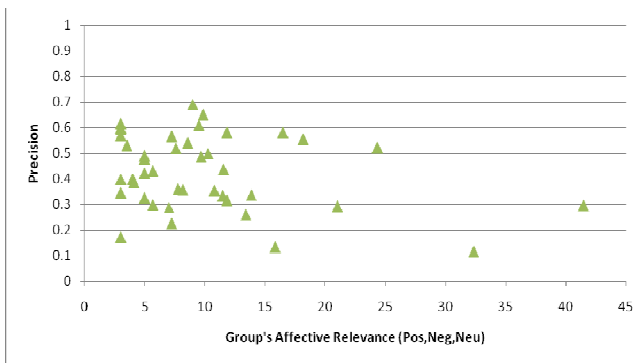


Figure 2: Dispersion Analysis of Precision in terms of GAR using neutral, positive, and negative information judgments.

In addition to the correlation analysis, we also generated clusters using *K-Means* over the number of positive, negative, and neutral information judgments as well as precision as a measure of performance. As a result we found three main clusters, namely low, medium, and high performance teams (Table 1).

Table 1: Clusters features.

	Cluster		
	Low Performance	Medium Performance	High Performance
Positive	10.40	4.57	1.65
Negative	1.60	0.86	0.26
Neutral	23.20	8.29	1.61
Precision	0.33	0.41	0.46

In terms of the characteristics of the clusters, we found that the closer the distance between the number of positive, negative, and neutral information judgments, the higher the performance of teams in terms of precision

6. PROPOSED MODEL

Our goal by introducing group's affective relevance in CIS is to provide better ways of emotional awareness [6,7] to individuals when they work collaboratively. To facilitate this, it is necessary that CIS systems provide ways of communication that allow group members to express and represent what they feel and think about

the information they collect and share. Such reactions or impressions could be measured in different ways; some examples are facial expression recognition, linguistic analyses, voice intonation, and galvanic response of the skin. Irrespective of the technical resources that we could use to measure effectively users' feelings, we propose a general model for implementing group's affective relevance as part of the communication channels that individuals use when they seek information collaboratively.

Figure 3 presents an activity diagram from one user's perspective in his/her interaction with the system and his/her collaborators, either synchronously or asynchronously. The hearts in some activities represent the presence, codification, and communication of emotions. Following the flow of activities in the model from its starting point, we have a user that has information need and this lead him/her to initiate the ISP, which could be expressed through the ISP model of Kuhlthau [8].

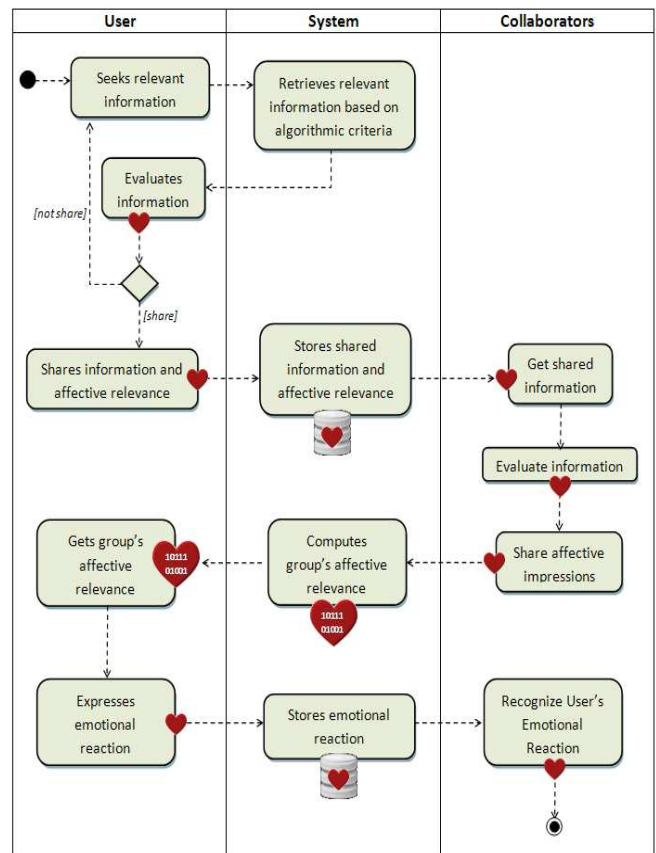


Figure 3: Model for implementing group's affective relevance in system for supporting CIS.

In the interaction with the system, the latter retrieves what according to algorithms is considered relevant. Then the user evaluates the information and selects what according to his/her criteria and affective experience is considered relevant. In this activity the user may react emotionally and this could be reflected either through the body or the language; as a result, the user decides whether share the information or not. In case the user shares the information, this includes his/her emotional response to the information object, that can be classified using either a dimensional or categorical approach of emotions.

As an intermediary, the system stores the information and its associated emotional reaction. Subsequently collaborators get and evaluate such information either objectively or subjectively. Hence, new affective judgments are added to the original information object and this is shared with the rest of the collaborators through the system. On the other hand, the system dynamically computes the group's affective relevance, using formulations similar to the ones presented in the previous section. The result of this is reported to the user who shared the information object, provoking an emotional reaction in him/her that might later be recognized by his/her peers through the system. The entire process is incremental and iterative; so the main idea of implementing this model and use it in experiments is to understand how users are affected by their peers when the information that they consider relevant is criticized either positively or negatively, and how this impacts the information seeking processes of the team.

7. DISCUSSION

Through this paper we proposed a new kind of relevance, namely group's affective relevance (GAR) in the context of collaborative information seeking (CIS). For understanding and evaluating GAR, we used data from a previous study; in particular, chat messages that were coded as positive, negative, and neutral. In addition, these messages were classified as exhibiting affective relevance if they included affective judgments of the information that the participants shared. We computed each group's GAR in two different ways (GAR₁ and GAR₂) and tried to link them to groups' performance in terms of precision. Overall, we found a weak and negative correlation using GAR₁, which is based on positivity and negativity. On the other hand, we found three main clusters that characterize teams in terms of the information judgments they reported during the information seeking process (ISP) and the performance they achieved also expressed in terms of precision. A lack of clear correlation could be attributed to the nature of this study, which was not designed to record or evaluate affective relevance. We will address this limitation with the future studies designed specifically for measuring GAR in CIS.

In addition we need to consider additional ways for exploring the emotional dimension of users in the ISP. As we noticed during the coding process, the linguistic approach is limited when used in isolation. To resolve this, in our next study we will examine the same problem under a multimodal approach, which will include the study of emotions using a multiple instruments.

Finally, as expressed in the model above, ideally GAR should be evaluated and studied for each information object that teams collect. Such study design will enable us to look at the dynamics of the teams when they decide whether the information being collected is relevant or not, and how such process affects their overall performance.

8. ACKNOWLEDGMENTS

A part of this work was supported by the National Science Foundation under grant # IIS 0812363.

9. REFERENCES

[1] Borlund, P. (2003). The concept of relevance in IR. *Journal of the American Society for Information Science and Technology*, 54(10), 913–925.

- [2] Budd, J.M. (2004) Relevance: Language, semantics, philosophy. *Library Trends*, 52(3), 447–462.
- [3] Cosijn, E., & Ingwersen, P. (2000). Dimensions of relevance. *Information Processing and Management*, 36(4), 533–550.
- [4] Dervin, B. & Nilan, M. (1986). *Information needs and uses*. In M. E. Williams (Ed.), *Annual Review of Information Science and Technology* 21, 3-33. White Plains, NY: Knowledge Industry Publishers.
- [5] Fredrickson, B.L. & Losada, M.F. (2005). The Positive Affect and the Complex Dynamics of Human Flourishing. *American Psychologist*, 60(7), 678-686.
- [6] García, O., Favela, J., & Machorro, R. (1999). Emotional awareness in collaborative systems. In *Proceedings of String Processing and Information Retrieval Symposium, 1999 and International Workshop on Groupware* (pp. 296-303).
- [7] González (2006). Evaluación de la Integración del Darse-Cuenta Emocional en una Aplicación Colaborativa. Master's Thesis, Universidad de Santiago de Chile. Santiago, Chile.
- [8] Kuhlthau, C.C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science*, 42(5), 361–371.
- [9] Losada, M., & Heaphy, E. (2004). The Role of Positivity and Connectivity in the Performance of Business Teams: A Nonlinear Dynamics Model. *American Behavioral Scientist*, 47(6): 740-765.
- [10] Merriam-Webster Online. (2009). Retrieved October 1, 2009, from <http://www.merriam-webster.com>.
- [11] Mizzaro, S. (1997). Relevance: The whole history. *Journal of the American Society for Information Science*, 48(9), 810–832.
- [12] Saracevic, T. (1996). Relevance reconsidered '96. Information science: Integration in perspective. In P. Ingwersen & N.O. Pors (Eds.), *Proceedings of Second International Conference on Conceptions of Library and Information Science (CoLIS 1996)* (pp. 201–218.). Copenhagen: The Royal School of Librarianship.
- [13] Saracevic, T. (2007) Relevance: A review of the literature and a framework for thinking on the notion in information science. Part II: Nature and manifestations of relevance. *Journal of the American Society for Information Science and Technology*, 58(13): 1915-1933.
- [14] Shah, C. & Marchionini, G. (2009). Query reuse in exploratory search tasks. Poster at Workshop on Human-Computer Interaction and Information Retrieval (HCIR) 2009. Washington, DC: October 23, 2009.
- [15] Shah, C. (2010). Coagmento - A Collaborative Information Seeking, Synthesis and Sense-Making Framework. Integrated demo at *CSCW 2010*. Savannah, GA: February 6-11, 2010.
- [16] Zhang, X. (2002). Collaborative relevance judgment: A group consensus method for evaluating user search performance. *Journal of the American Society for Information Science and Technology*, 53(3), 220-231.